

# ECON 222A

## Macroeconomic Theory I

Exchange Rates, Business Cycles,  
and Macroeconomic Policy  
in the Open Economy  
Lecture 19

# Today's Lecture

- The IS-LM Model for an Open Economy
- Macro Policy in a Small Open Economy

# IS-LM in an Open Economy

- Use IS-LM rather than AD-AS because we're focusing on the determination of  $(Y, r)$
- $r$  will impact the exchange rates and the international flows of goods and assets
- The framework:
  - $M^S, M^D$  the same, hence  $LM$  is the same
  - $N^S, N^D$  the same, hence  $FE$  is the same
  - But G&S market different, the  $IS$  is different
- Before  $Y = C + I + G$ , now  $Y = C + I + G + NX$

# IS-LM in an Open Economy

- We are going to consider a given inflation rate, both in the domestic economy and in the foreign one.
- $P$  and  $P_{For}$  grow at the same rate, so we can equate any change in  $e$  with changes in  $e_{nom}$

# The $IS$ curve

1. Downward sloping similar to the closed economy model
2. Factors that shift  $IS$  in the closed economy shift it in the open economy
3. Factors that affect  $NX$  will also shift the  $IS$  curve now

# Open Economy $IS$ Curve

- Goods market equilibrium needs to be amended:
  - Closed economy:  $S^d - I^d = 0$
  - Open economy:  $S^d - I^d = NX$
- Amount **domestic** residents want to **lend** abroad  
= Amount **foreigners** want to **borrow** from domestic savers (through  $CA$ )
- Goods market equilibrium is given by the intersection of the  $S^d - I^d$  curve and  $NX$  curve
- Alternatively:  $Y = C^d + I^d + G + NX$

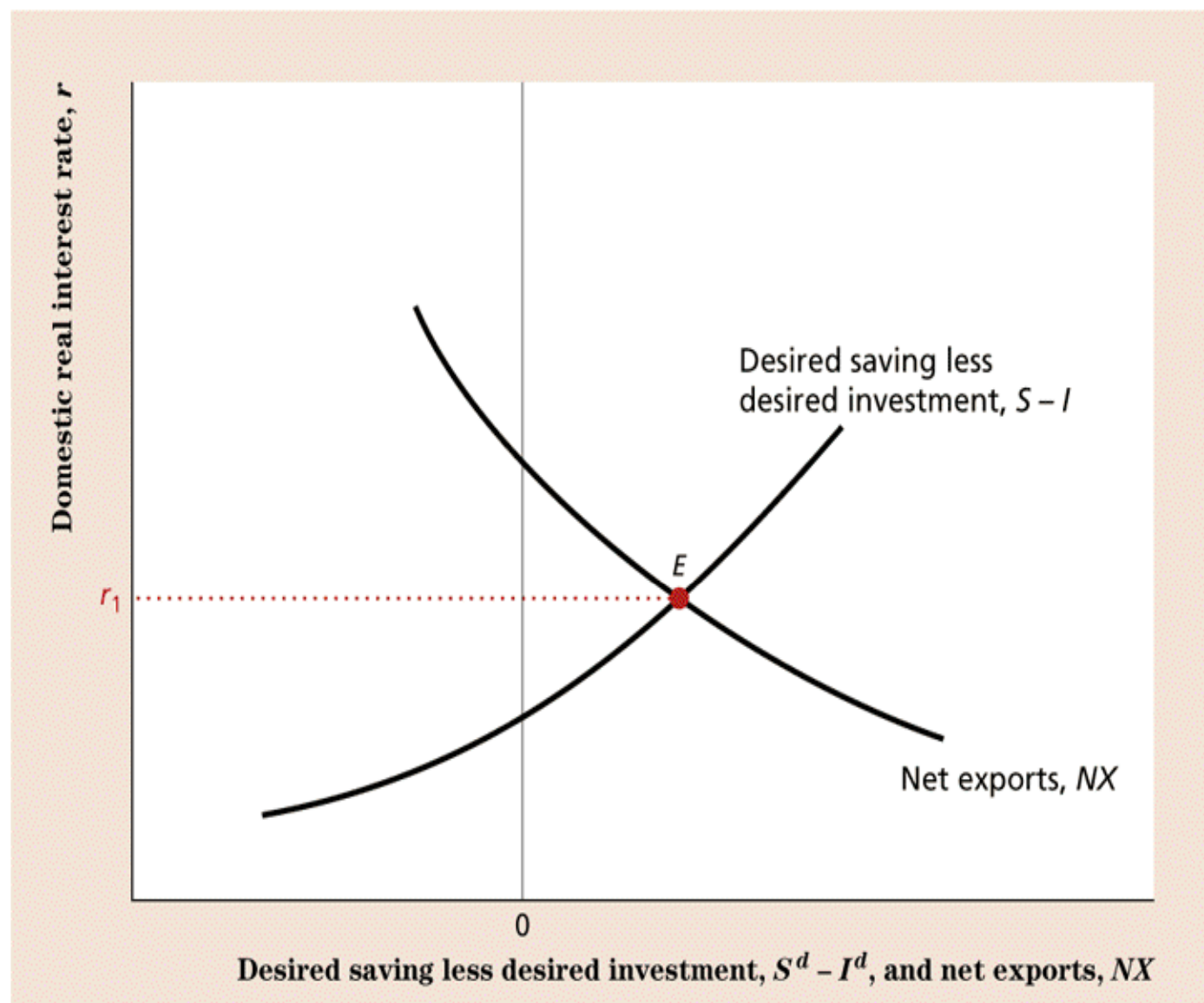
# Open Economy $IS$ Curve

- How to represent graphically the economy:
  - Plot  $S^d - I^d$  curve and  $NX$  curve
  - We are collapsing the behavior of  $S^d$  and  $I^d$
  - $S^d - I^d$  upward sloping, because with  $Y$  constant as  $r$  rises,  $S^d$  rises (high return) and  $I^d$  falls (more costly)
  - $NX$  curve downward sloping because of the indirect effect from last time:
    - $r$  rises, demand for CAD\$ rises,  $e_{nom}$  rises,  $NX$  falls

**FIGURE 10.4**

**GOODS MARKET  
EQUILIBRIUM IN AN OPEN  
ECONOMY**

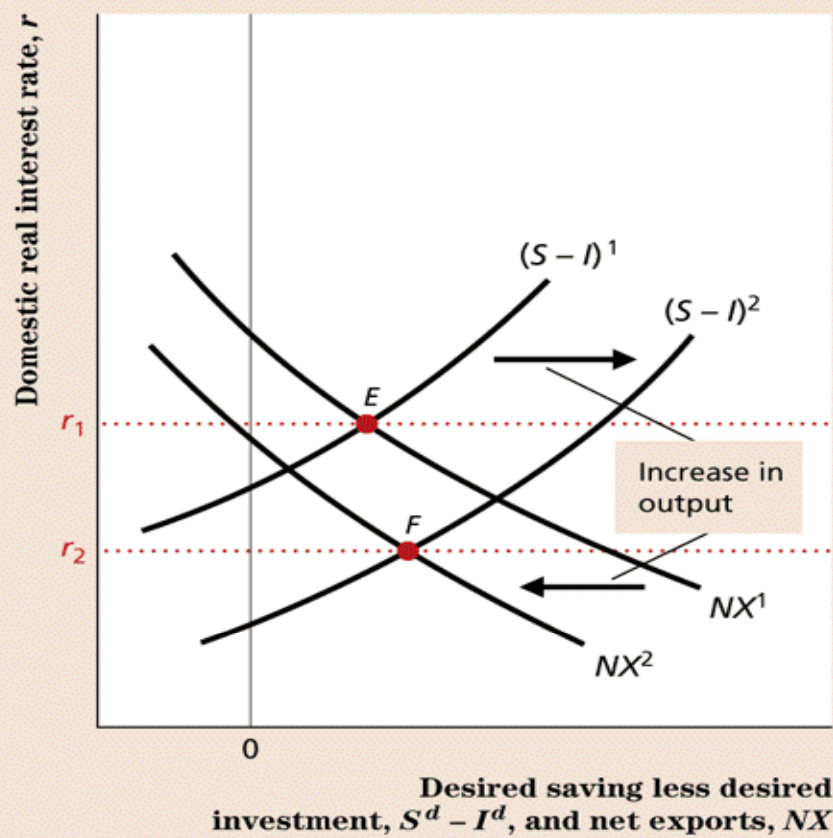
The upward-sloping curve shows desired saving  $S^d$  less desired investment  $I^d$ . This curve slopes upward because a higher domestic real interest rate increases the excess of desired saving over desired investment. The  $NX$  curve relates net exports to the domestic real interest rate. This curve slopes downward because a higher domestic real interest rate causes the real exchange rate to rise, reducing net exports. Goods market equilibrium occurs at point  $E$ , where the excess of desired saving over desired investment equals net exports (equivalently, where desired lending abroad equals desired borrowing by foreigners). The real interest rate that clears the goods market is  $r_1$ .



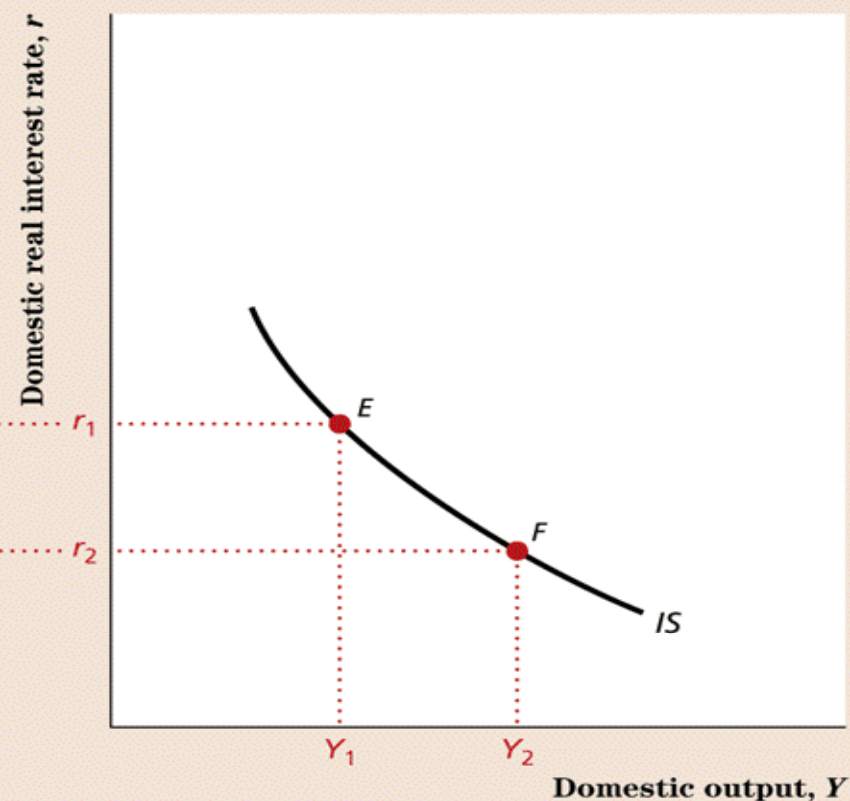


# Open Economy $IS$ Curve

- Same old trick:
  - increase  $Y$ , see what happens to the equilibrium  $r$
  - $Y$  rises, so  $S^d$  rises while  $I^d$  does not change
    - $S^d - I^d$  shifts out
  - $NX$  curve moves too
    - $Y$  rises means  $IM$  rises, so  $NX$  shifts in
  - Equilibrium  $r$  thus falls with increases in  $Y$
- Downward sloping  $IS$



(a) Goods market equilibrium



(b) Open-economy *IS* curve

## FIGURE 10.5

### DERIVATION OF THE *IS* CURVE IN AN OPEN ECONOMY

The initial equilibrium in the goods market is represented by point *E* in both (a) and (b).

(a) At point *E*, domestic output is  $Y_1$  and the domestic real interest rate is  $r_1$ . An increase in domestic output from  $Y_1$  to  $Y_2$  raises desired national saving at each real interest rate and does not affect desired investment. Therefore, the  $S - I$  curve shifts to the right, from

$(S - I)^1$  to  $(S - I)^2$ . The increase in output also raises domestic spending on imports, reducing net exports and causing the  $NX$  curve to shift to the left, from  $NX^1$  to  $NX^2$ . At the new equilibrium point, *F*, the real interest rate is  $r_2$ .

(b) Because an increase in output from  $Y_1$  to  $Y_2$  lowers the real interest rate that clears the goods market from  $r_1$  to  $r_2$ , the *IS* curve slopes downward.

# A Numerical Example

- Given the following, derive the open-economy IS curve:

$$C^d = 100 + 0.90Y - 300r$$

$$I^d = 60 - 150r$$

$$G = 50$$

$$NX = 40 - 0.20Y + 0.40Y_{\text{For}} - 50r$$

# A Numerical Example

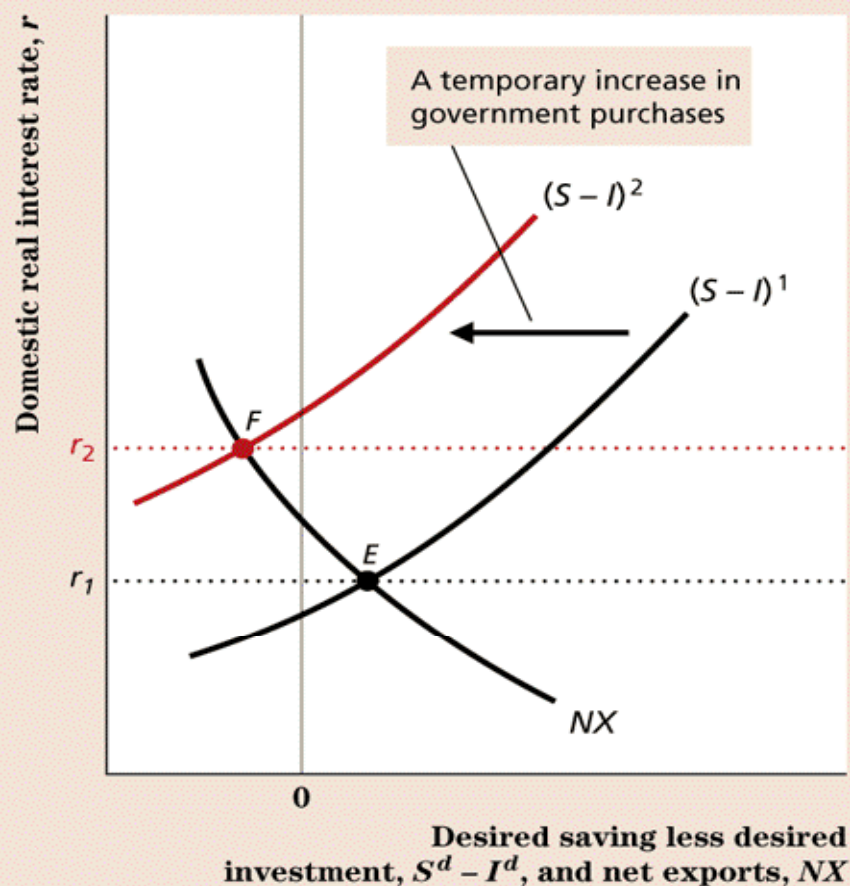
- How about the specification of the  $NX$ ?
- An increase in  $Y$  increases imports ( $NX$  curve shifts in)
- An increase in  $Y_{For}$  increases exports ( $NX$  curve shifts out)
- An increase in  $r$  makes domestic assets more attractive:  $\uparrow$  CAD \$ demand,  $\uparrow e_{nom}$  ( $\downarrow \downarrow NX = \downarrow X - \uparrow M$ )

# A Numerical Example

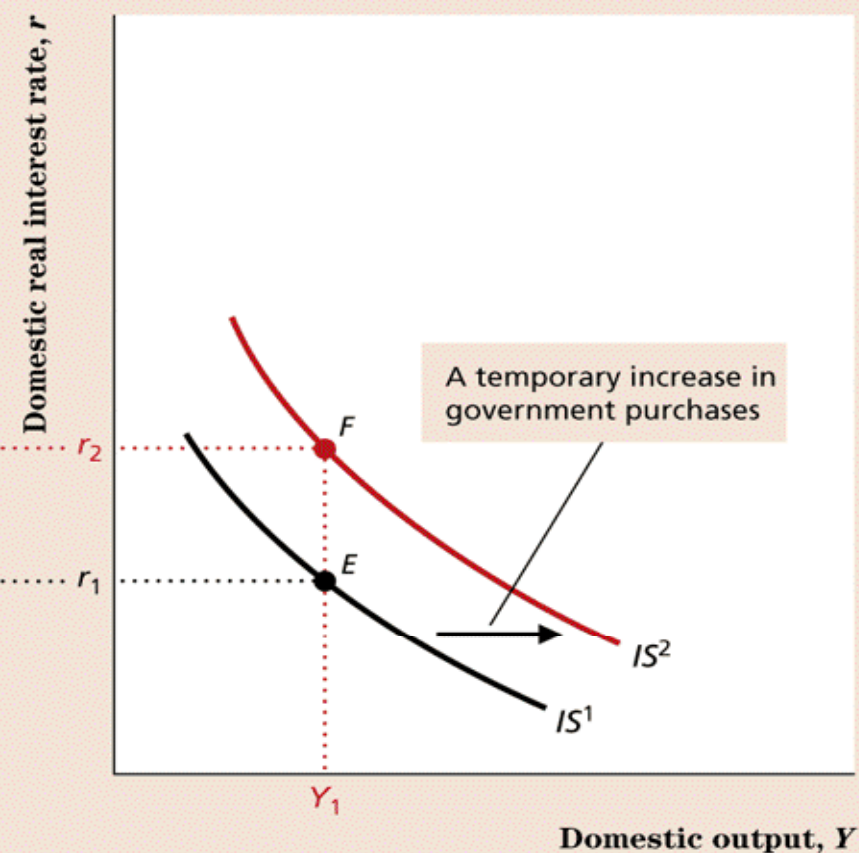
- $Y = C^d + I^d + G + NX$
- $Y = 100 + 0.9Y - 300r + 60 - 150r + 50$   
 $+ 40 - 0.2Y + 0.4Y_{for} - 50r$
- Collect terms:  $0.3Y = 250 - 500r + 0.4Y_{for}$
- $r = (1/500) \times (250 - 0.3Y + 0.4Y_{for})$

# Open Economy $IS$ Curve

- The Open-economy  $IS$  curve still slopes down
- The  $IS$  curve shifts up if (holding  $Y$  constant):
  - $G$  increases
  - $Y_{for}$  increases (in general, if the Net exports increase)
- 1. An increase in  $G$  implies less domestic savings ( $S^d - I^d$  falls)
- 2. An increase in  $r_{for}$  leads to a capital outflow,  $e_{nom}$  decreases, and  $NX$  increases



(a) Goods market equilibrium



(b) Open-economy  $IS$  curve

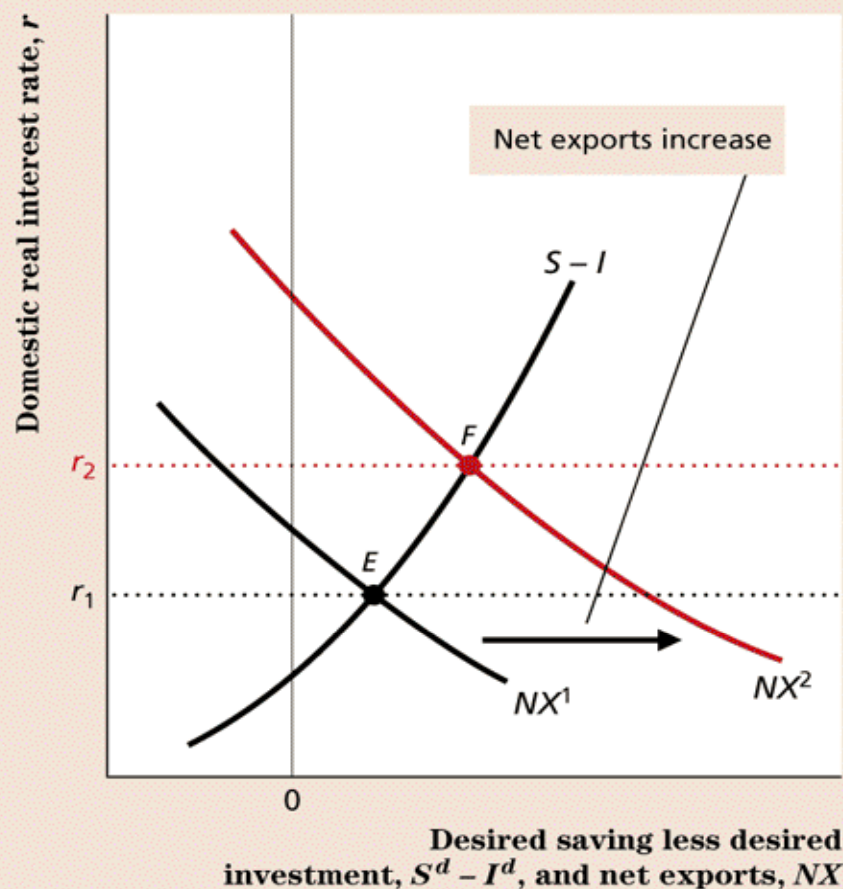
## FIGURE 10.6

### EFFECT OF AN INCREASE IN GOVERNMENT PURCHASES ON THE OPEN-ECONOMY $IS$ CURVE

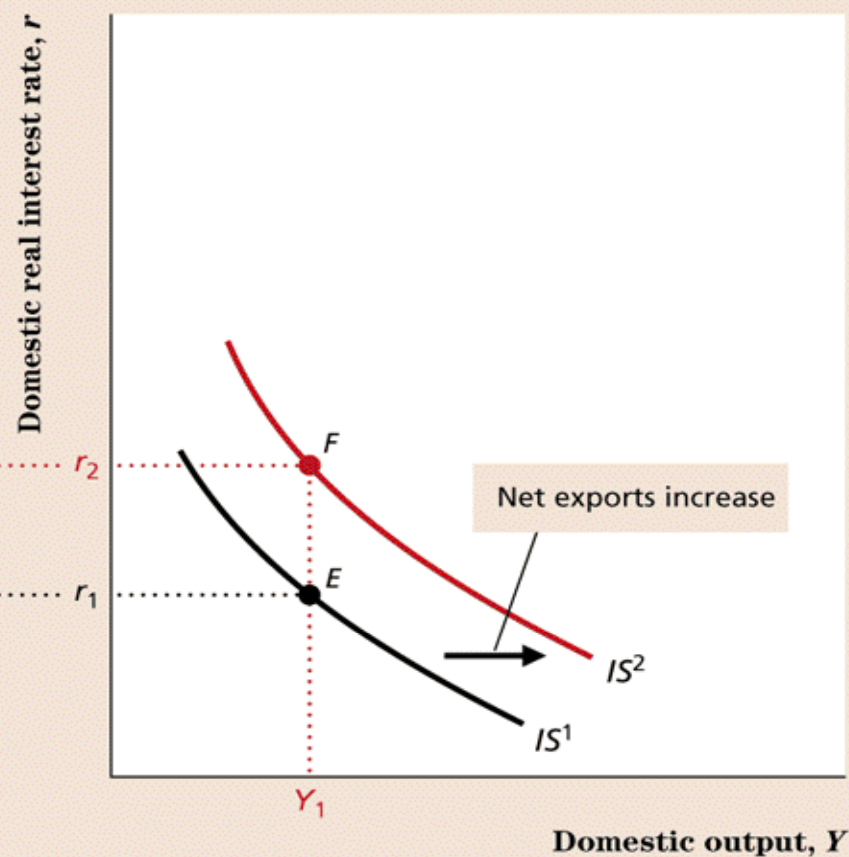
Initial equilibrium is at point  $E$ , where output is  $Y_1$  and the real interest rate is  $r_1$ , in both (a) and (b).

(a) A temporary increase in government purchases lowers desired national saving at every level of output and the real interest rate. Thus, the  $S - I$  curve shifts to the left, from  $(S - I)^1$  to  $(S - I)^2$ .

(b) For output  $Y_1$ , the real interest rate that clears the goods market is now  $r_2$ , at point  $F$  in both (a) and (b). Because the real interest rate that clears the goods market has risen, the  $IS$  curve shifts up and to the right, from  $IS^1$  to  $IS^2$ .



(a) Goods market equilibrium



(b) Open-economy IS curve

## FIGURE 10.7

### EFFECT OF AN INCREASE IN NET EXPORTS ON THE OPEN-ECONOMY IS CURVE

In both (a) and (b), at the initial equilibrium point,  $E$ , output is  $Y_1$  and the real interest rate that clears the goods market is  $r_1$ .

(a) If some change raises the country's net exports at any given domestic output and domestic real interest rate, the  $NX$  curve shifts to the right, from  $NX^1$  to  $NX^2$ .

(b) For output  $Y_1$ , the real interest rate that clears the goods market has risen from  $r_1$  to  $r_2$ , at point  $F$  in both (a) and (b). Thus, the  $IS$  curve shifts up and to the right, from  $IS^1$  to  $IS^2$ .



# Shifting the Open Economy *IS* Curve

- Fixing  $Y$ , anything that raises (lowers) equilibrium  $r$  shifts *IS* up (down)
  - e.g.: if  $G$  rises, *IS* shifts up
- Anything that shifted up closed *IS* will also shift open *IS*
- Also changes in  $NX$  will shift open *IS*
  - e.g.: if  $Y_{For}$  goes up

# Macro Policy, Small Open Economy with Flexible Exchange Rates

- *IS-LM* in the open economy allows us to look at fiscal and monetary policy
- Important because it can stabilize shocks
  - Example: if US goes into recession, *NX* for Canada falls, *IS* shifts in, *Y* falls!
  - We can offset this with policy

# Macro Policy, Small Open Economy with Flexible Exchange Rates

- Analyze using the *Mundell-Fleming* model
- *Assumptions:*
  - i) The domestic Economy is small (Canada doesn't impact the US economy)
  - ii) Savers expect no change in exchange rates
    - $r = r_{for}$  (Real Interest rate parity / no arbitrage)

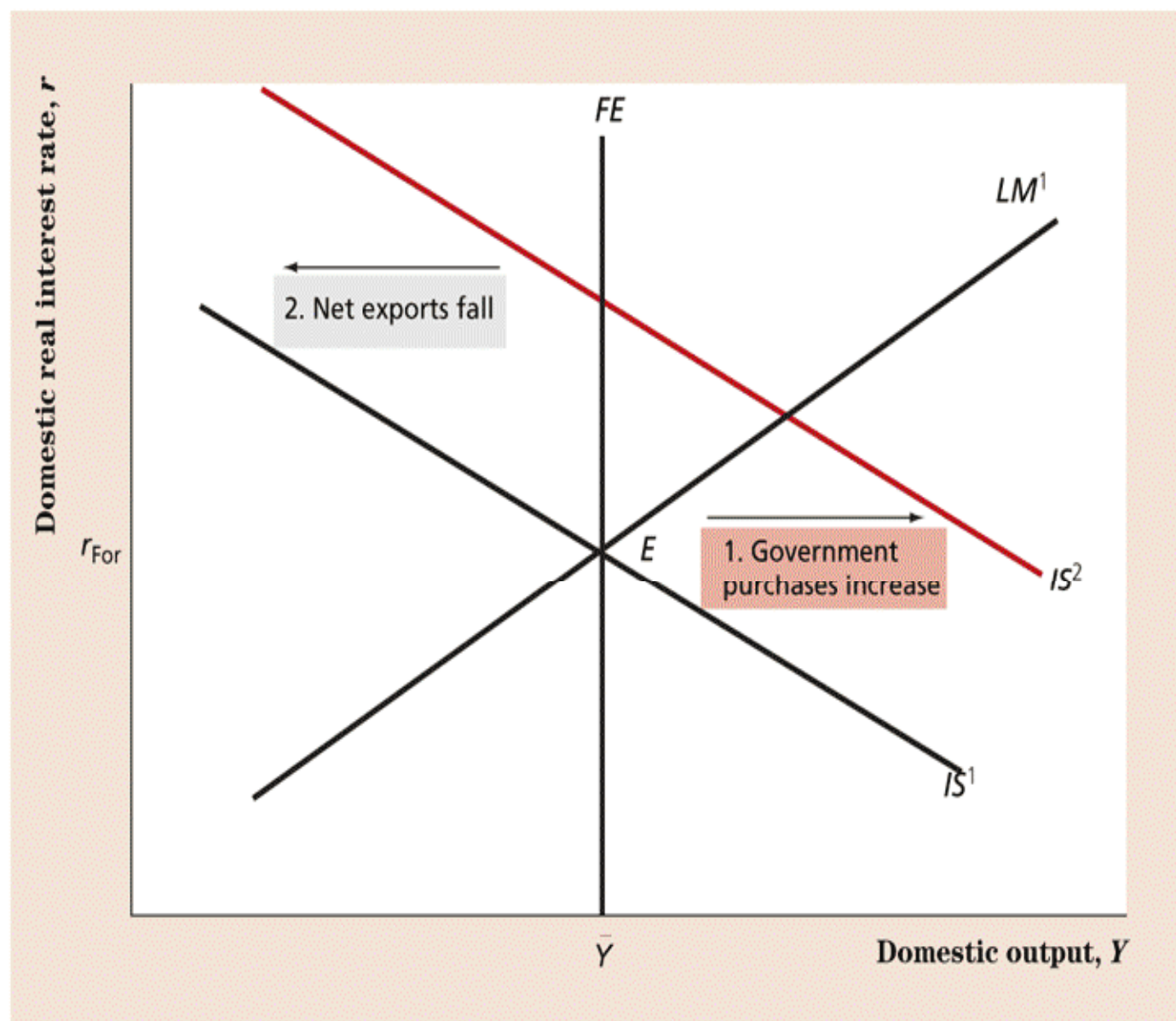
# Fiscal Expansion

- Start from the Long Run equilibrium,  $G$  rises temporarily
- Arbitrage gives  $r = r_{For}$
- What happens:
  - Short Run:  $IS$  shifts out and  $Y, r$  rise
  - $r$  is higher, which in the closed economy crowds out investments

## FIGURE 10.8

### AN INCREASE IN GOVERNMENT PURCHASES IN A SMALL OPEN ECONOMY WITH FLEXIBLE EXCHANGE RATES

An increase in government purchases shifts the  $IS$  curve up and to the right, from  $IS^1$  to  $IS^2$ . There results a temporary increase in the domestic interest rate above the foreign interest rate. As a consequence, the exchange rate appreciates, causing net exports to fall.  $IS^2$  must return to  $IS^1$  because only here does the exchange rate appreciation stop. There is no price level response unless the exchange rate is slow to respond to the temporary increase in the domestic interest rate. For this reason, the Keynesian short run, the Keynesian long run, and the classical model all generate the same result—general equilibrium remains at point  $E$ .



# Fiscal Expansion

- Not done yet, though:
  - Since  $r > r_{For}$ , arbitrage kicks in
  - Foreigners demand CAD \$ to use their savings in Canada
  - Long Run:  $e_{nom}$  rises, so  $NX$  falls until  $r = r_{For}$
- Overall:
  - A rise in  $G$  leads to a fall in  $NX$ 
    - this is the net export crowding out
  - If  $G$  rise by \$1,  $NX$  fall by \$1
    - so  $Y$  won't rise, meaning that there is no Long Run change in  $P$  (or  $LM$  curve shift)

# Fiscal Expansion

- The  $IS$  shifts back to its original position. If the response of the exchange rate is fast, there are no real effects, so there is no change in the price level  $P$
- Fiscal policy is ineffective in a Small Open Economy with flexible exchange rates
- It merely shifts the composition of domestic spending from  $NX$  to  $G$
- If fiscal policy can't work, can monetary policy?

# Monetary Expansion

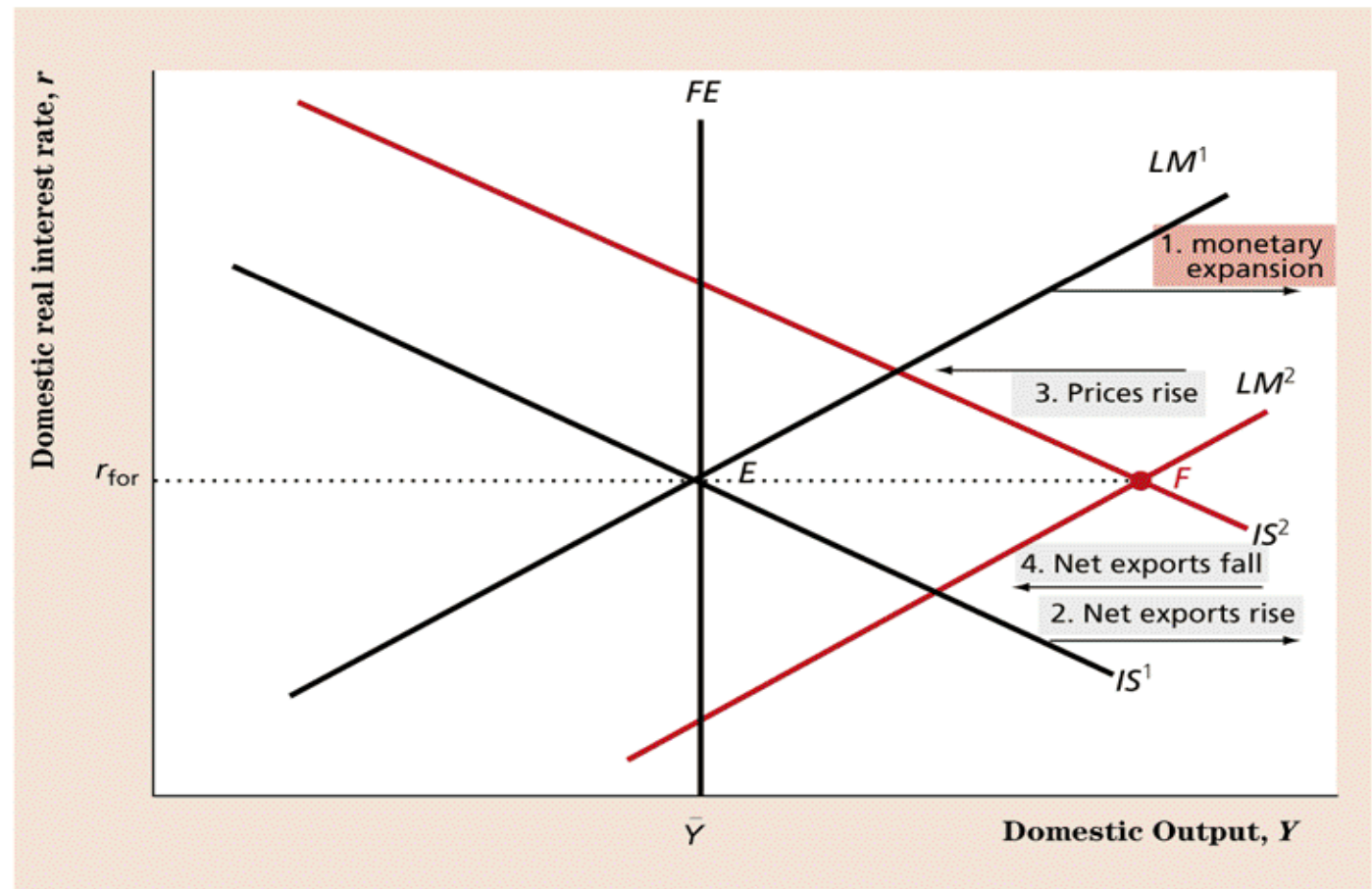
- Starting from the Long Run equilibrium again,  $M^s$  rises
- What happens:
- Short Run:  $LM$  curve shifts out,  $Y$  rises,  $r$  falls
- There is a short run difference between the domestic and the foreign interest rates,  $r < r_{For}$  so there are arbitrage opportunities



**FIGURE 10.9**

**A MONETARY EXPANSION  
IN A SMALL OPEN  
ECONOMY WITH FLEXIBLE  
EXCHANGE RATES**

A monetary expansion shifts the  $LM$  curve down and to the right, from  $LM^1$  to  $LM^2$ . In the Keynesian short run, there results a temporary decrease in the domestic interest rate below the foreign interest rate. As a consequence, the exchange rate depreciates, causing net exports to increase and causing the  $IS$  curve to shift up and to the right from  $IS^1$  to  $IS^2$ . The curves  $IS^2$  and  $LM^2$  must intersect at point  $F$ , where the domestic and foreign interest rates are equal. In the Keynesian long run, the domestic price level increases. This causes  $LM^2$  to shift up and to the left and causes the domestic interest rate to increase temporarily above the foreign interest rate. The currency appreciates, causing a fall in net exports. Both  $IS^2$  and  $LM^2$  return to their original positions at point  $E$ . In the classical model, equilibrium remains at point  $E$  throughout because of the rapid adjustment of the price level.



# Monetary Expansion

- Canadian assets are worth less now
  - Foreigners sell off Canadian assets (supply of dollars increases) causing  $e_{nom}$  to fall
  - with a lower nominal exchange rate the  $NX$  rises, shifting out the  $IS$  until  $r = r_{For}$
- With  $P$  fixed, results are:
  - $Y$  rises,  $r = r_{For}$  and  $NX$  rises

# Monetary Expansion

- However,  $Y$  is way bigger than full employment now.
- Firms will eventually raise  $P$ 
  - $M/P$  then falls,  $LM$  shifts in, and it all unravels
  - $r$  rises in the Short Run,  $e_{nom}$  then rises,  $NX$  falls,  $IS$  shifts in, until we are back to where we started
- There is once again monetary neutrality

# Monetary Expansion

- Keynesian approach: Long Run neutrality
- Classical: rapid price change,  $LM$  curve basically bounces back
- Real exchange rates have no Long Run change
- Nominal will rise though
  - if  $M$  rises by 10%, then  $P$  rises by 10%,  $e_{nom}$  rises by 10%
- Contractions: opposite